ARRAY OF ENERGY FILTERS FOR CHARGED PARTICLES MICROMACHINED IN <I JO> SILICON

R. E. Stalder, T.R. van Zandt, T. W. Kenny, M. H. Hecht and F. E. Grunthaner, Microdevice Technology Section, Jet Propulsion Laboratory, California Institute of Technology, CA 91109

We present the prototype of a micromachined energy filter for charged particles. The geometry is based on a Bessel box with twofold symmetry. A stack of silicon wafers with thicknesses of either 200 µm or 800 µm are aligned within a few µm and bonded together. Each wafer carries a micromachined, freestanding grid with openings on the 100 µm scale. The complete stack has no open areas (all straight lines intersect at least one wafer) but by applying the appropriate electrostatic potentials in between the individual wafers the resulting electric fields create an array of microlenses with a focal length depending on the kinetic energy of the particles. The acceptance fires in the phase space was determined by complete ray tracing simulations for all entrance angles and coordinates. The freestanding grids are micromachined by means of high aspect-ratio anisotropic KOH etch in <110> silicon. Given the twofold symmetry of the <110> crystal face the detector acts as a momentum filter in one direction, whereas no focusing occurs in the perpendicular direction. This behavior could be useful for the widening of the angular acceptance angle of a Time-of-Flight mass spectrometer.